STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
JAMES B. HUNT JR.
GOVERNOR
P.O. BOX 25201, RALEIGH, N.C. 27611-5201
DAVID MCCOY
SECRETARY

MEMORANDUM TO: Project Engineers
Project Design Engineers

FROM: T. V. Rountree, P. E.
State Bridge Design Engineer

DATE: December 7, 1999

SUBJECT: CULVERT OUTLET WINGS

As a result of coordination between the Hydraulics and Structure Design Units, the design and orientation of culvert outlet wings has been revised. Unless otherwise stated on the Culvert Survey and Hydraulic Design Report, in lieu of turned back wings, the culvert outlet wings shall be tapered extensions of the exterior barrel walls. The attached example details are to be used along with the following guidelines in plan preparation:

- Slope the top of the wings to parallel the roadway fill slope along the culvert skew. Provide a concrete apron extending the barrel floor slab and connecting the two outlet wings. Match the thickness of the apron to the barrel floor slab up to a maximum of 12" (300 mm).
- Locate the end of the wings where the wing height is 1'-6" (450 mm) above the top of the apron. Round the wing length appropriately.
- Detail dowel bars and horizontal bars in the wings to match the pattern of ‘C’ bars in the barrel walls. Detail dowel bars and ‘H’ bars at 12" (300 mm) centers in the top of the apron only. Use the attached chart to determine the required ‘N’ bar size and spacing in the fill face of each wing. Match the size and spacing of the ‘A’ bars in the bottom of the apron to that of the ‘N’ bars. Splay, rather than cut off, both mats of ‘A’ bars at the end of the apron.
- Provide weepholes in the outlet wings as necessary to continue the approximate spacing of 10 ft. (3 m) used in the barrel walls.

- Detail a curtain wall at the end of the concrete apron reinforced with additional bent ‘K’ bars. Size the S2 bars used in the curtain wall to match those in the headwall.

- Provide filter fabric and Class I riprap within the limits shown on the attached detail. Include in the Total Structure Quantities two special culvert pay items for "Filter Fabric for Drainage" in square yards (square meters) and "Plain Rip Rap Class I (2'-0" Thick) (600 mm Thick)" in tons (metric tons).

- Include the entire area of the concrete apron between the tapered wings in the calculation of required foundation conditioning material.

Modify the culvert barrel standard drawings by replacing the turned back wings and footings with a portion of the tapered outlet wings. In most cases, an additional sheet will be required to illustrate the full length and details of the outlet wings.

The details include a vertical construction joint between the outlet wings and the barrel. Place the following note on the plans:

> ***At the Contractors option the vertical construction joint between the outlet wings and the barrel may be eliminated and the 'C' bars in the barrel may be extended to replace the 'D' and 'H' bars in the wings and slab.***

Prepare a separate Reinforcing Schedule and Bill of Material for the outlet wings including the dowel bars.

These details apply only to the outlet end of culverts or the outlet end of culvert extensions. Do not use these details in conjunction with bottomless culverts. For culverts with a barrel height greater than 12 ft. (3.7 m) or a skew outside the range of 45 to 135 degrees, design outlet wings on a case by case basis.

This policy is effective with all new plans prepared but no later than the July 2000 letting. The Design Manual and Culvert Standards will be revised at a later date.

TVR/RGW/RDR/

Attachments

1.English ``Outlet Wing Section Normal to Roadway", sheet 1 of 3.

2.English ``Plan-Outlet Wings", sheet 2 of 3.

3.English ``Outlet Wing Rip Rap Details", sheet 3 of 3.

1.Metric ``Outlet Wing Section Normal to Roadway", sheet 1 of 3.

2.Metric ``Plan-Outlet Wings", sheet 2 of 3.

3.Metric ``Outlet Wing Rip Rap Details", sheet 3 of 3.

Culvert Outlet Wing Reinforcement

Barrel Height	'N' Bars
1.8m (6 ft) or less	#13 bars at 300mm (#4 bars at 12") centers
2.1m (7 ft)	#16 bars at 300mm (#5 bars at 12") centers
2.4m (8 ft)	#16 bars at 300mm (#5 bars at 12") centers
2.7m (9 ft)	#19 bars at 300mm (#6 bars at 12") centers
3.0m (10 ft)	#19 bars at 220mm (#6 bars at 9") centers

3.4m (11 ft)	#19 bars at 150mm (#6 bars at 6") centers
3.7m (12 ft)	#19 bars at 150mm (#6 bars at 6") centers for 65° – 115° skews #22 bars at 150mm (#7 bars at 6") centers for skews less than 65° and greater than 115°
• For skews less than 45° and greater than 135° , or barrel heights greater than 3.7m (12 ft), design outlet wings on a case by case basis. • For 3.4m (11 ft) and 3.7m (12 ft) barrel heights, reduce the 'N' bar reinforcement to #13 bars at 300mm (#4 bars at 12") centers from the midpoint to the end of the wing.	

Back to Structures Main Page
Last Updated: 12/9/99 by:Robert Wright
E-mail Structure Design